Climate variability, kelps, and the Southern California red abalone fishery.

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Declines in landings in Southern California abalone fisheries and the eventual collapse of many stocks over the last two decades coincided with a period of greatly increased environmental variability. This included massive storms, an increase in the frequency of warm-water El Nino events after 1977, and an interdecadal-scale increase in sea surface temperatures.

Kelp populations may be decimated by severe storms or warm water. Because of the strong inverse relationship between nitrate availability and water temperature, temperature is a good indicator of nitrate availability or stress; kelp growth ceases in warm nutrient-depleted water, tissue decays, and standing stocks may be greatly reduced.

Abalones are directly affected by the availability of the drift kelp on which they feed, anomalously-warm temperatures may affect reproduction, and altered current patterns may affect larval dispersal.

Because water temperature varies with location in Southern California and each of the five exploited species has its own thermal preferences, we chose to evaluate the role of environmental variability on red (Haliotis rufescens) abalone populations off three northern Channel Islands spanning a temperature gradient. We evaluate evidence for poor abalone growth and reproduction during El Nino events, water temperature anomalies, and monthly aerial survey data of giant kelp (Macrocystis pyrifera) canopies.

The severity of El Nino disturbances and long-term changes in kelp standing stocks both correlated with the temperature gradient. Despite major long-term changes in kelp populations on the warmest island, the time scale of the decline in abalone landings predates the decline in kelps.

The subsequent collapse of many populations, however, and especially the recovery of these depleted populations, may be directly related to kelp declines. Southern California abalones evolved in this disturbance regime, but the combination of extended periods of increased environmental variability with intense fishing pressure may have led to the loss of local populations, especially in warmer areas.

Descriptors: El Nino phenomena; Climatic changes; Gastropod fisheries; Environmental effects; Recruitment; Haliotis rufescens; Macrocystis pyrifera; INE, USA, California.